



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/628,188	07/28/2003	George J. Fechko JR.	5000.302	6095

21176 7590 10/18/2005

SUMMA & ALLAN, P.A.
11610 NORTH COMMUNITY HOUSE ROAD
SUITE 200
CHARLOTTE, NC 28277

EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
----------	--------------

1722

DATE MAILED: 10/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/628,188

Applicant(s)

FECHKO ET AL.

Examiner

Matthew J. Song

Art Unit

1722

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 May 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) 9,10,20,30 and 31 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8,11-19,21-29 and 32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 5/2/05;5/3/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-8, 11-19, 21-29 and 32, drawn to a method, classified in class 117, subclass 84.
- II. Claims 9-10, 20, 30, and 31, drawn to a product, classified in class 257, subclass 77.

2. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by another and materially different process, such as CVD.

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Brian Johnson on 8/16/2005 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-8, 11-19, 21-29 and 32.

Affirmation of this election must be made by applicant in replying to this Office action. Claims

Art Unit: 1722

9-10, 20 and 30-31 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1-7, 11-17, 21-29 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carter (US 2001/0019132 A1) in view of Otani et al (JP 08-208380), an English abstract and Computer translation (CT) have been provided.

In a method of forming silicon carbide, note entire reference, Carter discloses a method of forming bulk silicon carbide by heating a silicon carbide source powder to sublimation in a growth chamber, heating and then maintaining a silicon carbide seed crystal in the growth

Art Unit: 1722

chamber to a temperature, which sublimed species will condense on the seed crystal, continuing to heat the silicon carbide source until a desired amount of silicon carbide has occurred on the seed crystal ([0015]).

Carter et al does not disclose introducing an ambient gas containing hydrogen into a sublimation chamber.

In a method of producing silicon crystalline silicon carbide, note entire reference, Otani et al teaches a gaseous hydrogen is incorporated into inert gas such as Ar and the resultant gas is used as atmospheric gas for a silicon carbide single crystal grown by a sublimation-recrystallization method (Abstract). Otani et al also teaches using hydrogen and argon as a controlled atmosphere to control diffusion of molecular species, which contribute to growth, and allows for production conditions of ideal stoichiometry silicon carbide monocrystal with few defects (CT [0006]-[0009]), this reads on applicant's reducing nitrogen incorporated into the growing crystal by controlling the hydrogen concentration of the ambient atmosphere because nitrogen incorporation would have the SiC to deviate from ideal stoichiometry. Otani et al also teaches carrying out pressure control and the maintaining the internal pressure at about 600-10 Torr (CT [0011]-[0012]). Otani et al teaches 1 ppm-90% hydrogen gas as a controlled atmosphere (CT [0008]) and specifically 1% hydrogen for a pressure of 600-10 Torr (CT [0012]).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Carter by using a hydrogen atmosphere, as taught by Otani et al, to form a silicon carbide single crystal with few defects and ideal stoichiometry.

Referring to claim to claim 2, the combination of Carter and Otani et al teaches a internal pressure of 600-10 Torr (CT [0012]). Overlapping ranges are held to be obvious (MPEP 2144.05). Furthermore, pressure is a well known result effective variable; therefore it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Carter and Otani et al by optimizing the pressure to obtain the claimed range by conducting routine experimentation of a result effective variable (MPEP 2144.05).

Referring to claim 3, the combination of Carter and Otani et al does not teach the claimed flow rate, however it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Carter and Otani et al by using the claimed flow rate to obtain a desired concentration of hydrogen in the ambient atmosphere.

Referring to claim 4-5, the combination of Carter and Otani et al teaches a seed crystal and temperatures ('132 [0031] and [0038]).

Referring to claim 6-7, the combination of Carter and Otani et al teaches a nitrogen concentration of $5 \times 10^{16} \text{ cm}^{-3}$ or less. Overlapping ranges are held to be obvious (MPEP 2144.05) and the combination of Carter and Otani et al teaches a similar method sublimation using a hydrogen ambient; therefore the claimed nitrogen concentration is inherent to the combination of Carter and Otani et al because a similar method is expected to produce a similar product.

Referring to claim 11, the combination of Carter and Otani et al does not teach the maintaining an ambient concentration of hydrogen in the growth chamber sufficient to passivate the growing silicon carbide. However, this limitation is inherent since the combination of Carter and Otani et al teaches an overlapping range of hydrogen, specifically 1% hydrogen for a

Art Unit: 1722

pressure of 600-10 Torr (CT [0012]), as taught by applicant, note instant claim 12; therefore a similar amount of hydrogen is expected to produce similar results.

7. Claims 8 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carter (US 2001/0019132 A1) in view of Otani et al (JP 08-208380), an English abstract and Computer translation (CT) have been provided, as applied to claims 1-7, 11-17, 21-29 and 32 above, and further in view of Maeda (JP 06-128094), an English Abstract and Computer translation (CT2) have been provided.

The combination of Carter and Otani et al teach all of the limitations of claim 8, as discussed previously, except introducing a hydrocarbon species into the growth chamber to establish the hydrogen ambient.

In a method of producing silicon carbide single crystals, note entire reference, Maeda teaches introducing a carbon component gas such as propane, this reads on applicant's hydrocarbon. Maeda teaches the introduction of propane cancels out the variation in the sublimated gas composition generated from the silicon carbide raw material into a crystal growth zone. Maeda also teaches a stoichiometrically pure and high quality product can be produced (Abstract).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Carter and Otani et al by using a hydrocarbon gas, as taught by Maeda, to produce a stoichiometrically pure and high quality product.

Art Unit: 1722

8. Claims 8, 11-18, 21-29 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carter (US 2001/0019132 A1) in view of Otani et al (JP 08-208380), an English abstract and Computer translation (CT) have been provided, and Maeda (JP 06-128094), an English Abstract and Computer translation (CT2) have been provided, as applied to claims 8 and 18 above, and further in view of Barrett et al (US 5,611,955).

The combination of Carter, Otani et al and Maeda teach all of the limitations of claim 11, as discussed previously, except maintaining an ambient concentration of hydrogen in the growth chamber sufficient to passivate the growing silicon carbide crystal. The Examiner maintains the feature would be inherent to the combination of Carter and Otani, however the Examiner's inherency position is further evidenced by Barrett et al.

In a method of forming silicon carbide single crystals, note entire reference, Barrett et al teaches a silicon carbide single crystal grown by sublimation. Barrett et al teaches non-metallic impurities such as hydrogen may serve as passivating traps for shallow residual impurities (col 2, ln 35 to col 3, ln 55).

The combination of Carter, Otani et al, and Maeda does not teach passivating with hydrogen, however this feature would be inherent because the combination of Carter, Otani et al, and Maeda teaches a similar method of sublimation in a hydrogen ambient within an overlapping ranges, as applicants; therefore passivation is inherent because a similar method is expected to produce a similar and passivation is evidenced by Barrett et al, which teaches a hydrogen ambient can be used to passivate a silicon carbide single crystal.

Conclusion

Art Unit: 1722

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MJS
October 12, 2005

Matthew J Song
Examiner
Art Unit 1722



ROBERT KUNEMUND
PRIMARY EXAMINER